Spontaneous Dissection with Rupture of the Superior Mesenteric Artery From Segmental Arterial Mediolysis: A Case Report and Review of the Literature

Michael N. Tameo, Matthew J. Dougherty, MD, and Keith D. Calligaro, MD, Pennsylvania Hospital, Philadelphia, Pa

Background: Spontaneous dissection of the superior mesenteric artery (SMA) is rare. We report a case of rupture of the SMA after spontaneous dissection in a 51-year-old man who presented with acute onset of abdominal pain and hypotension. The patient was diagnosed as having segmental arterial mediolysis (SAM).

Case: The patient was initially treated with intravenous fluid resuscitation and endovascular intervention, followed by open surgery. The relevant features of the case as well as SAM are presented. In addition, a review of all available published literature on SAM to date is presented. No identifiable cause for dissection was found. The patient was diagnosed as having SAM. He did well and was discharged home on postoperative day 8. A follow-up CT scan showed additional disease characteristic of SAM in a branch of the inferior mesenteric artery that was treated with coil embolization.

Conclusions: SAM is a rare arteriopathy of unknown etiology. Differential diagnosis includes fibromuscular dysplasia and inflammatory arteritis such as polyarteritis nodosa. Differentiation is important, because there is no standard treatment for SAM.

Parallel Session II–Basic Science

In Vivo Evaluation of a Hand-Held, Battery-Operated Therapeutic Ultrasound Device for the Noninvasive Treatment of Varicose Veins

Peter W. Henderson, MD MBA, Allie M. Sohn, BS, Aleid Koppius, BS, George K. Lewis, Jr, BS, William L. Olbricht, PhD, and Jason A. Spector, MD, Weill Cornell Medical College, New York, NY, and Ithaca, NY

Objectives: Current treatments for varicose veins and other vascular malformations are to some degree invasive and may therefore be painful and associated with complications such as infection, thrombophlebitis, and bleeding. The development of entirely noninvasive techniques has been hampered by the high cost, large size, and power requirements of candidate technologies, such as high-intensity focused ultrasound (HIFU) imaging. Our group has developed a HIFU device that is hand-held and battery-operated, and we have previously demonstrated that it is capable of venous ablation ex vivo. The purpose of this study was to determine whether it is capable of transcutaneous venous ablation in vivo.

Methods: Our HIFU device weighs 560 grams and has an intensity of 2500 W/cm^2 that focuses at a focal length of 3.3 mm. A midline laparotomy was performed on four Sprague-Dawley rats to expose the IVC. The HIFU transducer was covered in a plane 2 mm from the focal point with a piece of previously harvested rat skin, and under direct visualization, the device was applied to the IVC and activated for 60 seconds.

Results: Compared with the condition of the IVC before HIFU treatment, the IVC after HIFU was marked by significant contraction and coagulation necrosis. There was no antegrade blood flow from the IVC after transection at the level immediately superior to the treated area, indicating complete venous occlusion. Furthermore, there was no evidence of necrosis in any of the adjacent tissues.

Conclusions: In contrast to previous HIFU devices, ours is hand-held, portable, and relatively inexpensive. Although subsequent prototypes will incorporate visualization capabilities, the current device required a modified experimental design that allowed for direct visualization while assessing the ability to effectively ablate veins in a transcutaneous fashion. Our results indicate that this device is capable of successful, targeted, transcutaneous venous ablation in vivo. Because this technique is completely noninvasive, it has the potential to minimize the visible scars and other complications that can be associated with more invasive procedures. Accordingly, we believe that interventions based upon this technology may provide a superior treatment option for varicosities and other vascular malformations.

Regulation of Membrane-Type Matrix Metalloproteinase Expression by Recanalization and Flow During Thrombus Resolution

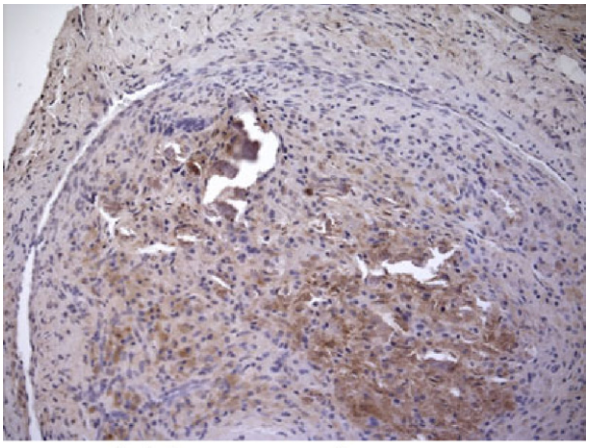
Mohammed Chaudry, MD, Christine Chabasse, PhD, and Rajabrata Sarkar, MD, PhD, University of Maryland, Baltimore, Md

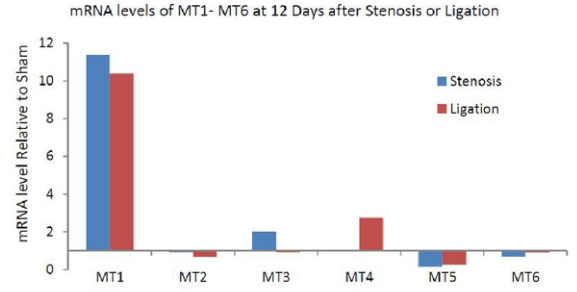
Objectives: Expression and activity of matrix metalloproteinase (MMP) enzymes is important in the process of venous thrombus resolution. Expression of the membrane-type MMP family of genes (MT-MMPs) in thrombus resolution, and the regulation of their expression by blood flow (recanalization) remain undefined. We tested the hypothesis that thrombus resolution would activate these genes and that recanalization would further regulate their expression.

Methods: CD1 mice underwent surgical inferior vena cava (IVC) ligation (stasis thrombosis), IVC stenosis (thrombosis with recanalization), or a sham procedure. We analyzed thrombus weight over time as a measure of thrombus resolution, and studied mRNA levels of MT-MMP genes by real-time PCR of mRNA extracted from thrombus + vein wall, as well as protein expression by Western blotting and immunohistochemistry. Statistical analysis was by ANOVA and t test ($P < .05$).

Results: Thrombus resolution was 28% and 32% greater ($P < .05$) in the stenosis vs the ligation model on postoperative day (POD) 8 and 12 (n = 5-13). Thrombus resolution induced MT-1 (>4-fold vs sham on POD 8 + 12; $P < .05$) but the stenosis model demonstrated a more significant induction early (1.83 vs 1.15, POD4; $P < .05$). Thrombus resolution repressed MT-2 expression (0.2-fold, POD4; $P < .05$) in both stasis and recanalization models, and initially induced (8-fold, POD4; $P < .05$) but then repressed MT-5 and MT-6 expression. MT-4 expression increased late (2.8-fold, POD12; $P < .05$) selectively in the stasis model, whereas MT-3 had the opposite induction only in the recanalization model (2-fold; $P < .05$). Pro- and active MMP2 protein and gelatinase activity were increased in recanalization > stasis > sham. MT1 and MT3 expression localized around areas of recanalization during thrombus resolution.

Conclusions: These studies demonstrate that the expression of MT-MMP family of genes is differentially induced and repressed during the process of thrombus resolution, further localized in focal areas of recanalization within the thrombus. These findings increase our knowledge of the biology of venous thrombus resolution and identify pathways that may serve as therapeutic targets to accelerate thrombus resolution.





M. Chaudry, None; **C. Chabasse**, None; **R. Sarkar**, None.

Human Adult Stem Cells Restore Endothelial Migratory Dysfunction in a Hypoxic Environment

Sarah Fernandez, MD, Rachel Song, BS, Jason Comeau, MD, Stephen McIlhenny, PhD, Hamid Abdollahi, MD, Ping Zhang, PhD, Thomas N. Tulenko, PhD, and Paul J. DiMuzio, MD, Thomas Jefferson University Hospital, Philadelphia, Pa

Objectives: Adipose-derived stem cells (ASCs) injected into the blood stream after an ischemic event promote therapeutic angiogenesis in affected tissues. It has been suggested that the stem cells exert their influence by way of a paracrine effect on native endothelial cells (ECs). Using an in vitro model, we evaluated the effect of ASC coculture on EC function in a hypoxic environment.

Methods: Confluent monolayers of human ECs grown on the bottom of transwell plates were wounded to create an even 5-mm defect and cultured in either normoxic (21%) or hypoxic (1%) conditions. Human ASCs were cocultured on the top of the transwell plates to evaluate a paracrine effect. Subsequently, EC migration was determined by measuring the wound size after 3 days. Media samples were collected, and the VEGF concentration was measured by using ELISA. RNA from ASCs incubated in hypoxia for varying time lengths was evaluated using PCR for various growth